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Volume 2, Number 3 (March 1978)

The OTEC Liaison

AN INTERNATIONAL NEWSLETTER ENGAGED AS LIAISON FOR THE COMMUNITY OF OCEAN THERMAL ENERGY CONVERSION

Offshore Oil Industry Enters OTEC Field

FOUR TEAMS BID FOR OTEC-1 PLATFORM

On April 3rd four corporate teams turned in their proposals in response to the RFP described in the December issue of *The OTEC Liaison: System Integration Contractor (SIC) to Design, Fabricate, Convert/Modify, Assemble, Test, Deploy, Manage, and Operate an Ocean Test Platform for DOE's Ocean Thermal-Energy Conversion (OTEC) Test Program: The platform and test loop are designated OTEC-1.* The four teams are: Lockheed Missiles and Space Company Incorporated, a subsidiary of Lockheed Aircraft Corporation; Global Marine TRW; Systems Development Corporation/Southeast Drilling (SDC/SEDCO); and Offshore Drilling and Exploration Company (ODECO)/Gibbs and Cox/Stanwick Corporation. Orals are still scheduled for late April to mid-May, with the award announcement in July and the go-ahead in September.

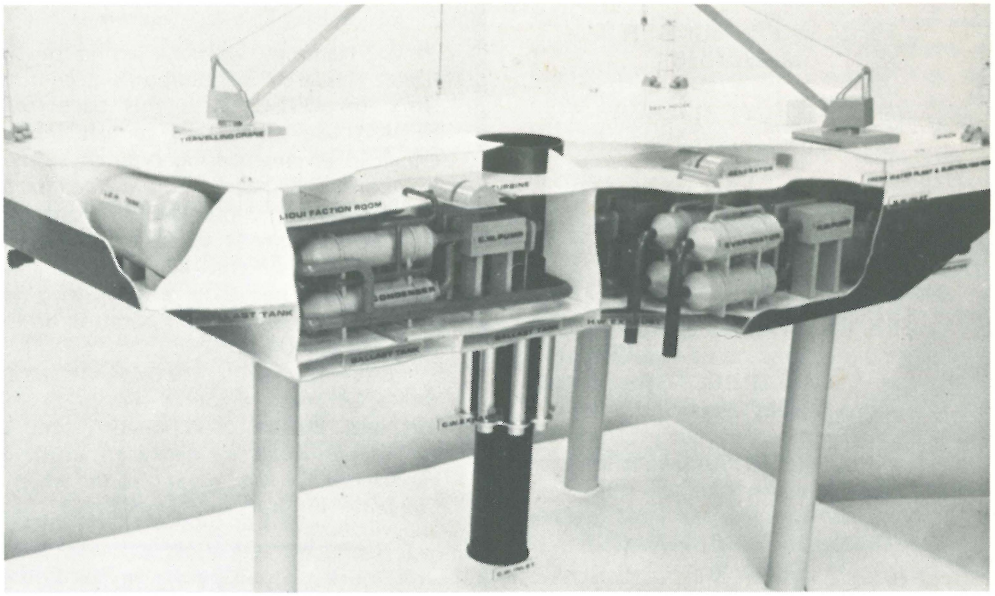

Photo Credit—EL, Tokyo

***The OTEC Liaison* recently received from Japan two conceptual drawings of their proposed 100 MWe OTEC power plants which were not shown at the Miami conference. Above is the floating-type concept of the OTEC Committee in Japan, and below their submerged type.**

EXPERIENCED FIRMS INTENSIFY OTEC ROLE

The entrance of firms experienced in the retrieval of both onshore and offshore oil into an active part in the OTEC field is both a welcome and a natural evolution in the development of ocean thermal energy. Ironically, it is the depletion of the world's oil reserves that has brought increased intentness to alternative energy systems such as OTEC and, consequently, swung the attention of these international firms to augmenting their extraction of energy from the world's oceans.

One of the four teams now bidding for OTEC-1 is that of Southeastern Drilling Company (SEDCO) of Dallas, a 27-year-old firm that began in the Southeastern US with a couple of land-drilling rigs. Of the 80 rigs that SEDCO now has operating, only one is in the US. Of the 27 offshore rigs, 10 are in the North Sea, with others spread around the world. These include four in Nigeria, three in Borneo, and others in Mexico, South Africa, Norway, and elsewhere. Seven of the offshore rigs were built within the last three years, with some running as high as $65 million each.

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VOLUME 2 NUMBER 3
March 1978

SEDCO's Interest in OTEC Goes Back Three Years

In a conversation with SEDCO's Dillard Hammett, *The OTEC Liaison* was told that about three years ago a number of petroleum companies working for the government asked them, for example, what a ship could do, what a semi could do, what could be dynamically stationed, what deck loads are, and so on. SEDCO then participated in some of the studies being done with various firms, including Lockheed. With a large engineering and operating staff experienced in both the oceans and the energy field, SEDCO became increasingly interested in OTEC, and wanted to be "prepared five or ten years down the line". SEDCO is also involved in deep-ocean mining, with a vessel out now in 18,000 feet of water in the Pacific. This project

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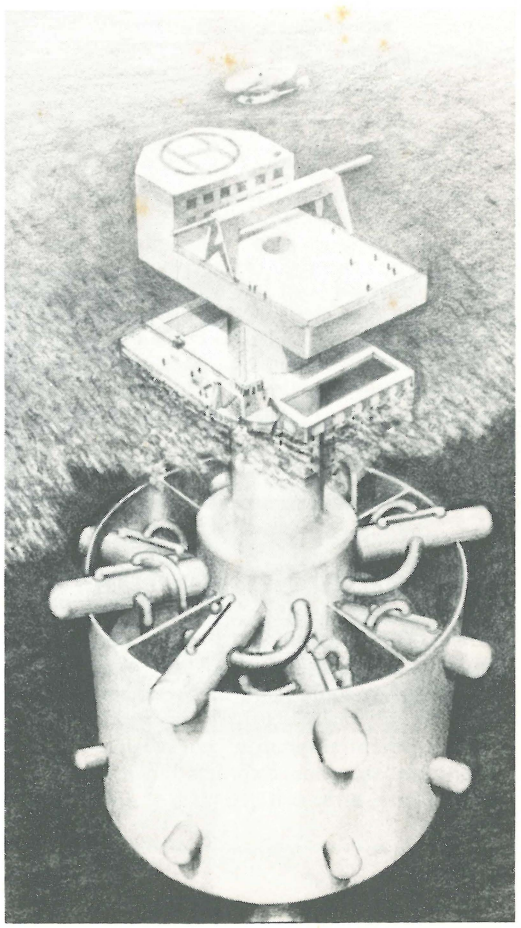

Photo Credit—EL, Tokyo

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Please Subscribe!

The OTEC Liaison will provide continued *liaison* [from the French: *an instance or means of communication between bodies, groups, or units*] to the community of ocean thermal-energy conversion, with response to your expressed needs. Your comments and criticisms are welcomed.

(continued from Page 1)

has been in operation about three years and will be completed this spring. Hammett said: "They gain a lot of experience on deployment of pipe, water temperatures," and the retrieval of other related data.

SEDCO Chooses Role As Sub-Contractor

Mr. Hammett participated in the National Research Foundation's preliminary work on OTEC. With this background, SEDCO had to decide to get involved either in an engineering type of study or in operational work, and opted for the latter. They are interested in long-range commercial aspects of OTEC, and chose to work not as a contractor, but as a subcontractor. Thus they are working with Systems Development Corporation on their joint bid for OTEC-1.

Hammett added: "We think we can save the government a lot of money in going out and testing" components, and said he feels it is advantageous to utilize the experience of an organization which is "already out in the ocean".

TWO FIRMS RECEIVE OTEC CONTRACTS

Westinghouse Electric Corporation and Lockheed Missiles and Space Company have signed Department of Energy contracts to design Ocean Thermal Energy Conversion (OTEC) systems. The two companies will prepare conceptual and preliminary designs of commercial-scale OTEC power systems in addition to designs of a smaller pilot plant that will be a scaled-down version of the larger system.

Although exact sizes will be determined during the design efforts, a commercial-size OTEC system conceivably might link several individual modules each generating as much as 50,000 kilowatts. In addition to the preliminary design efforts, each company will design a 1,000-kilowatt heat exchanger for testing on board OTEC-1, an ocean-going test platform being used by DOE to test and evaluate individual OTEC components. OTEC-1 is anchored at Hunter's Point in San Francisco.

Westinghouse's contract totals $2.9 million, while Lockheed's is for $1.3 million. The companies are two of three selected from competitive procurements last summer to enter into contract negotiations for work on OTEC power-systems designs. Such systems would pump warm surface water through heat exchangers where the water's heat would evaporate ammonia. The ammonia vapor would turn a turbine generator to make electricity before being condensed by cooler water from depths of about 3,000 feet. Contract negotiations with TRW Incorporated, the third company selected, are still underway.

Following completion of the designs in September 1978, DOE will select one or more of the designs for actual fabrication of an ocean-based pilot plant producing 5,000 to 12,000 kilowatts of electricity.

COAL STRIKE FOCUSES ON NATION'S LACK OF AN INTEGRATED POWER SYSTEM

Important Implications for OTEC

Regional and national transmission grids have been proposed in engineering studies in this country for years; but the Northeast power blackout of 1965 and the New York City blackout of 1967 have prodded government officials to take action. After last July's blackout, President Carter asked the Department of Energy to investigate a possible national grid system that would allow a more orderly and structured method of transmitting power to an imperiled utility on an emergency basis. Taken nationally, the country has power to spare from alternative sources of generation such as hydroelectric or natural gas, but most local power companies do not have interconnections strong enough to import power from distant sources.

Bill Introduced to Establish National Grid

In August the late Senator Lee Metcalf of Montana introduced a bill (S 1991) that would establish a national grid. Representative Richard L. Ottinger of New York introduced a companion bill (HR 8793) in the House. The measure would set up a National Power Grid Corporation and regional transmission corporations, empowering them to issue bonds to finance their operations. The three members of the national corporation would represent, respectively, private power companies, public power agencies, and the interests of consumers. The national body would operate a system feeding power into the regional systems and transferring power from one to the other. The grid corporation could purchase, for resale, surplus electricity generated by any utility, private or public.

Co-operative Grids Long Established in Foreign Countries

In Europe, such grids have been operating for as long as 50 years. Sweden has had a national backbone transmission system, interconnecting private companies and public systems, ever since the 1920s. France, West Germany, Belgium, and the Netherlands have been linked for years in an integrated international grid serving 130,000,000 people. No major shortages or cascading blackouts have been suffered on these systems.

BELL AEROSPACE TEXTRON STUDIES COLD-WATER PIPE

The Textron Division of Bell Aerospace, New Orleans, is currently studying the cold-water pipe for OTEC plants. It is considering a flexible pipe of nylon, rubber, or a combination of these or other materials.

LBL RESEARCHERS STUDY OTEC ENVIRONMENTAL ASPECT

Scientists at the Lawrence Berkeley Laboratory (LBL) of the University of California are studying microscopic bits of ocean life to determine how power plants operated by differences in seawater temperature can minimize their effect on the environment.

These scientists, headed by LBL oceanographers Pat Wilde and James Sandusky, are designing ways to measure such factors as the amount and type of microscopic plant life found in regions considered likely for the operation of OTEC power plants.

Their plan is to work closely with other scientists in areas off the coasts of Hawaii and Puerto Rico and in the Gulf of Mexico to determine how the biology of tropical ocean waters changes over long periods of time. Once this is done, they believe comparisons can be made with such physical and chemical conditions as water temperature, current direction, and dissolved oxygen content to predict what environmental changes, if any, might be created by introducing OTEC power plants.

OTEC is a concept now being developed by the US Department of Energy to make use of the enormous quantities of heat trapped when sunlight hits surfaces of tropical ocean water. Because temperature differences between upper and lower layers of ocean water occur day and night, many experts consider it the only form of solar power capable of generating electricity 24 hours a day. But current construction plans, involving the testing of pre-commercial designs, have convinced OTEC designers that the earliest a commercial prototype OTEC plant could begin operating is 1986, according to Wilde.

If and when such a plant is constructed, present designs suggest that it will operate by siphoning warm water from the surface and mixing this surface water's heat, through a freely-circulating liquid, with cold water pumped from depths of as much as 2,500 feet. The idea is that a low-boiling-point liquid such as ammonia or propane could be heated by this warm water to generate enough vapor to operate electricity-producing turbines. And once this vapor passed the turbines, cold water would condense it back to a liquid which could be returned and recycled through the system.

The problem, however, is that this mixing of warm and cold water changes the temperature of the surrounding waters. And pumping seawater through pipes for long periods of time might add small amounts of metals to the ocean at higher-than-normal concentrations. These and other effects, such as the mechanical process of raising water laden with growth-promoting nutrients to the ocean's surface, have caused environmentalists to wonder how ocean life might be affected by OTEC power plants.

The reason for this concern, according to Wilde, is that many ocean organisms—particularly the microscopic plants called phytoplankton—grow best under specific environmental conditions. This means that if temperatures and chemicals normally found in ocean water are changed, species of phytoplankton usually present in small numbers might come to predominate. Such a change, Wilde adds, could increase the number of microscopic animals that feed exclusively on these plants. And this increase could then result in an alteration of the number and kind of fish commonly found in that particular region.

Because of the key role that plants and small animals play in the biology of a region, Wilde's studies are directed at cataloguing such organisms as phytoplankton, shrimp, and fish and linking their abundance to a variety of chemical and physical conditions. These studies, he adds, will be of particular interest to commercial fisheries which depend on such information to predict their annual catch of seafood.

The project is being funded by a research grant from the Department of Energy. The gathering of physical, biological, and chemical data will be undertaken in conjunction with scientists from Hawaii, Puerto Rico, and New Orleans contracted by LBL. These scientists will conduct most of the measurements, says Wilde, while LBL scientists will supervise, design experiments, and analyze results.

"Our basic purpose is to monitor properties of the environment for periods of as long as five years," says Wilde. "With this information, we can work closely with the Environmental Protection Agency (EPA) and OTEC designers to ensure that the power plants meet basic environmental standards."

"The result," he adds, "is that we'll have an idea of how every piece of equipment going into OTEC affects the environment before these power plants are even constructed."

NEWSBRIEFS

ENERGY RESEARCH GETS $6.1 BILLION

President Carter has signed a bill authorizing $6.1 billion for energy research, the White House announced at the end of February. The measure, which was signed February 25th, provides the Department of Energy with money for research into developing additional sources of power, including wind and solar applications. The definitive allotment of this money will be decided during the next few months as a result of conferences of Congress's Energy Committees.

DOE RECEIVES A THOUSAND ENERGY PROPOSALS

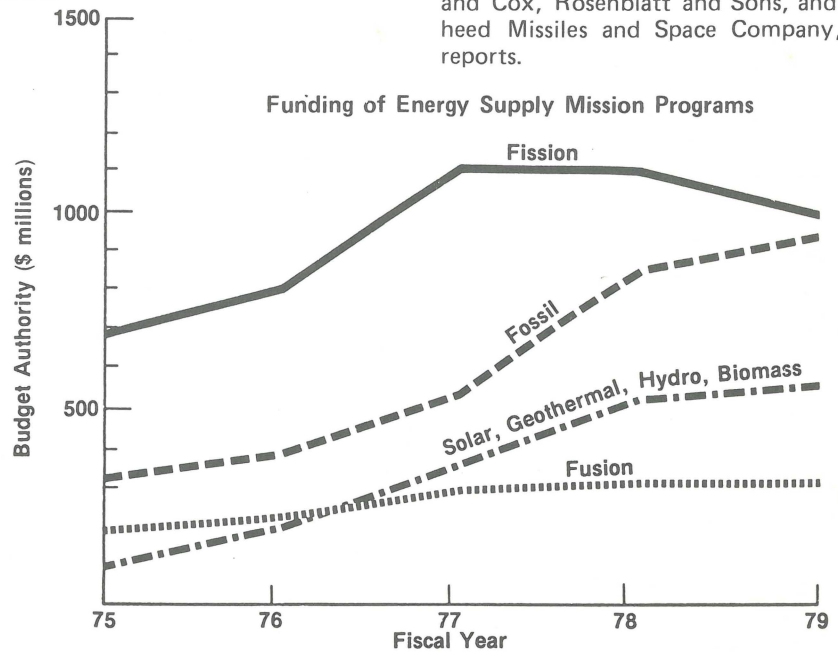
In response to an announcement by the Department of Energy's San Francisco office last September, 1120 proposals for the development of small-scale energy systems have been received and are being processed. The ideas include wind generators, solar heaters, tidal motors, and the use of plant or wood material for energy. Small grants ranging from less than $10,000 to $50,000, utilizing total funds of $3 million, will be awarded. Ideas came from individuals, low-income communities, colleges, inventors, non-profit organizations, and others.

POTENTIAL AMMONIA LEAKS INVESTIGATED BY DOW

The US Department of Energy (DOE) has awarded Dow Chemical Company a three-to-four-month contract to investigate aluminum corrosion to determine the effect of various concentrations of ammonia in a seawater environment.

DESIGN CONTRACTS AWARDED

Design-study contracts for an ocean testing platform have been let to Gibbs and Cox, Rosenblatt and Sons, and Lockheed Missiles and Space Company, DOE reports.



US GOVERNMENT PROCUREMENT INVITATIONS AND CONTRACT AWARDS

Listed below are procurement invitations and contract awards related to OTEC in particular and ocean resources in general culled from the *Commerce Business Daily*. This is not to be construed, however, as a complete list.

● **Mar 29: Naval Architect-Engineer Services for 10Mw(e) Ocean Thermal Energy Conversion (OTEC) Pilot Platform:** Naval architect-engineer services for (1) preparation of conceptual, preliminary, and contractual design specifications, cost and schedule estimates for a 10Mw(e) Modular Pilot Platform, and (2) on-site support at the OTEC systems integration contractor's plant, shipyard, or operating base for the 1Mw(e) and 10Mw(e) OTEC Modular Pilot Plants to (a) monitor scheduled tests and inspection certifications, (b) review design plans, specifications, and as-built drawings, (c) provide the naval architect and cost review for all change orders, (d) review all required interface functions, and (e) provide technical reviews of structural, civil, mechanical, and electrical designs and cost estimates. It is anticipated that a 12-month cost-plus-fixed-fee contract with two 12-month extensions will be negotiated with the selected firm for such services in sufficient time to initiate work starting approximately mid-June 1978. Any contract extensions will be based on the satisfactory performance of the contractor and the availability of funds. In addition to the above services, the following naval architect-engineer services for OTEC platforms, computer and wave tank modeling, station keeping, cold-water pipe, model testing, and electrical-transmission hull interfaces may be provided under separate task orders: (1) conceptual design services; (2) preparation and/or analysis of cost estimates and schedules based on DOE approved design and working drawings and specifications; (3) review and analysis of design drawings and specifications by others for compliance with DOE standards, industry practice, and code requirements, and preparation of design reports to present the results; and (4) preliminary design services. The actual work, if any, for such services will be accomplished during a period of one-year increments under individual task orders pursuant to a basic "agreement" to be included in the anticipated contract. Each task order will be negotiated separately and shall not exceed $50,000 with an aggregate amount of all tasks not to exceed $100,000 per year. However, no minimum or maximum number of tasks or dollar amount of task(s) are guaranteed. The estimated cost of services is approximately $500,000 for the first year and $500,000 for each of the next two years. The major effort the first year will be preparation of the conceptual, preliminary, and contract-design specifications for the 10Mw(e) OTEC Modular Pilot Platform. The next two years, the major effort will be reviewing of the system-integration contractor's plans, specifications, and providing field-inspection services for the 1Mw(e) and 10Mw(e) OTEC Modular Pilot Plants. The closing date for this announcement is 17 Apr 78. Late submissions will be considered only if in the best interest of the Government. The selection of a naval architect-engineer for negotiation will be based on the evaluation criteria contained in the Energy Research and Development Administration Procurement Regulation 9-4.1004.2 except for Subparagraphs (a) (7) and (a) (9) and experience of personnel with cold-water-pipe (CWP) design, deployment methodology, and computer analytical support for design verification of the CWP/RISER subsystem and with marine concrete/steel hull-structure design. This is not a request for proposal. See Note 63. The term "interview" as used in Note 63 means "discussion", which in turn is defined to include telephone conversations, exchange of correspondence, or interviews. (086) N. Hansen, Contractor Selection Board, Engineering, Construction, and Facilities Management Division, US Department of Energy, 9800 South Cass Avenue, Argonne IL 60439.

● **Mar 29: Development of Analytical Tools Which Implement the Ocean Thermal-Energy Conversion (OTEC) Cold-Water-Pipe Structural Analysis Theory:** Experimental, Test, and Research Work Contract 03-78-G03-0504, $74,116, to Hydronautics Inc., 7210 Pindell Road, Laurel MD 20810. NOAA Data Buoy Office, National Space Technology Laboratories, NSTL Station, MS 39529.

Mar 29: Parameterization of Turbulent Transfer Processes in Shallow Seas: Contract 78-A01-4063, $39, 158, to Woods Hole Oceanographic Institute, Woods Hole MA 02543. US Department of Commerce, Office of Administrative Services and Procurement, Washington DC 20230.

Mar 29: Thermoregulation of Fish and Turtles in Thermally-Stressed Habitats: Contract EY-76-S-02-2502.A001, for $35,670, to the Research Foundation of the State University of New York, Albany NY 12201.

Mar 29: Energy Conservation Via Heat-Transfer Enhancement: Contract ET-78-S-02-4649, $280,000, for three years, to Iowa State University, Department of Mechanical Engineering, Ames IA 50011.

Mar 29: Further Research on Boring Damage to Underwater Naval Structures, Systematics, and Development of Marine Boring Organisms: Contract N00014-76-C-0281, 1 Mar 78 (no RFP), $78,008, to President and Fellows of Harvard College, Holyoke Center 458, Cambridge MA 02138.

● **Apr 4: Definition of Ocean Thermal Resource for OTEC:** Contract ET-78-C-01-2899: Negotiations are being conducted with Ocean Data Systems Inc., Rockville MD 20852.

INTERNATIONAL CALENDAR

Listed below are conferences and symposiums pertinent to the OTEC community, ocean energy, and oceanographic technology. Major meetings recently completed are still listed for the benefit of any readers who wish to contact conference organizers for reports of proceedings.

Apr 3-14: Short Course: Design of Fixed Offshore Platforms—A Comprehensive Review", Joe C. Thompson Conference Center, University of Texas at Austin, fee $600. Info: Engineering Institutes, College of Engineering, Cockrell Hall 2.102, University of Texas at Austin, Austin 78712, (512) 471-3506.

Apr 16-23: National Oceans Week '78: Washington DC. Sponsored by the American Oceanic Organization with the cooperation of the Waterfront Washington Association. Info: American Oceanic Organization, 1815 N. Fort Myer Drive, Arlington VA 22209, (703) 527-0888.

Apr 24-27: Middle East Solar Technology Exhibit and Conference, Hilton Hotel, Bahrain.

May 3: Sun Day, on the order of the 1970 Earth Day: Washington DC (?) Info: Solar Action, 1028 Connecticut Ave. NW, Room 1100, Washington DC 20036.

May 3-6: 3rd General Assembly of the Engineering Commission on Oceanic Resources: National Academy of Sciences, Washington DC. Info: B. W. Carroll, Marine Board, NAS, 2101 Constitution Ave. NW, Washington DC 20418, (202) 389-6602.

● **May 8-11:** 1978 Offshore Technology Conference (OTC), Astrohall, Houston TX. Info: Offshore Technology Conference, 6200 N. Central Expressway Dallas TX 75206.

May 11-14: American Energy Expo: New York Coliseum. Info: Ralph J. Ianuzzi, American Energy Expo, 78 East 56th St., New York NY 10022.

May 31: 2nd Annual Doherty Lecture in Oceans Policy, National Academy of Sciences, Washington DC. Sponsored by the Center for Oceans Law and Policy, University of Virginia. Info: Penny Harrison, Washington Representative, 1901 N. Moore St., Suite 805, Arlington VA 22209, (703) 522-2727.

● **Jul 30-Aug 4:** Circum-Pacific Energy and Mineral Resources Conference: Honolulu HI. Sponsored by the American Association of Petroleum Geologists, the Commission for Co-ordination of Joint Prospecting for Mineral Resources in Asian Offshore Waters, the Pacific Science Association, the American Mining Congress, and the University of Hawaii. Info: 1978 Circum-Pacific Conference, c/o AAPG, PO Box 979, Tulsa OK 74101.